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FIRE DOOR ASSEMBLY

Technical Field

[0001] The present invention relates generally to an entry door for a building and, more specifically, to a fire-resistant building door construction.

Background of the Invention

[0002] Fire-resistant doors or fire doors as they are referred to in the industry, are used in various locations throughout a commercial building. Fire doors may also be used in residential buildings in accordance with various local codes.

[0003] One type of fire door uses a thick sheet of fire-resistant insulating material that completely fills the area between the outer skins of the door. The fire-resistant insulating material is a dense material that substantially increases the weight of the door. Also, known types of fire-resistant insulating materials are relatively expensive. One completely filled solid core door is described in U.S. Patent 4,695,494. Because this door uses the fire-resistant insulating material through its thickness the cost and weight are relatively high.

[0004] Another fire-resistant door is described in U.S. Patent 4,811,538. This door comprises a single sheet of fire-resistant insulating material that is support between the door skins. Spacers are provided on either side of the fire-resistant insulating material to support the door skins. Upon the testing of a similar configuration, applicant concluded

that such a door configuration does not provide adequate fire protection during testing.

[0005] It would therefore be desirable to provide a fire-resistant door that is less expensive to manufacture than current doors as well as fire-resistant to predetermined codes.

[0006] It would therefore be desirable to provide a fire resistant door assembly that reduces the cost of the installation of the door.

Summary Of The Invention

[0007] The present invention provides an improved fire-resistant door that includes a plurality of spacers. The spacers have a first side and a second side. A first sheet of fire-resistant insulating material coupled to the first side. A second sheet of fire-resistant insulating material is coupled to the second side. A first outer skin is coupled to the first sheet opposite said plurality of spacers. A second outer skin is coupled to the second sheet opposite the plurality of spacers.

[0008] A method for assembling a door comprises:

coupling a plurality of spaced-apart spacers between a first sheet of fire-resistant insulating material and a second sheet of fire-resistant insulating material;

coupling a first outer skin to the first sheet of fire-resistant material; and

coupling a second outer skin to the second sheet of fire-resistant insulating material.

[0009] One advantage of the invention is that by providing a void between the layers of fire-resistant insulating material, the door is lighter weight than previously known fire doors. Also, the doors are less costly because the fire-resistant insulating material does not extend through the thickness of the door.

[0010] Other advantages and features of the present invention will become apparent when viewed in light of the detailed description of the preferred embodiment when taken in conjunction with the attached drawings and appended claims.

Brief Description Of The Drawings

[0011] Figure 1 is an elevational view of a door assembly according to the present invention.

[0012] Figure 2 is a cross-sectional view of a door assembly in a closed position according to the present invention.

[0013] Figure 3 is an exploded view of a door assembly according to the present invention.

[0014] Figure 4 is a partial cross-section of an alternative embodiment of the invention.

Detailed Description Of The Preferred Embodiment

[0015] In the following figures, the same reference numerals will be used to illustrate the same components in the various views. The present invention is described and illustrated with respect to flat-skinned commercial doors. However, various types of shapes and style doors may be formed according to the present invention.

[0016] Referring now to Figures 1-3, a door 10 is illustrated having a frame 12 around its perimeter. Frame 12 comprises a horizontal header 14 and vertical jambs 16 that are used for mounting the door within the building. Horizontal header 14 and vertical jambs 16 may be formed of a variety of materials including wood, metal or a composite material. Preferably, in commercial door environments, horizontal header 14 and vertical jambs 16 are formed from metal. As is best shown in Figure 2, a fire stop 15 may be coupled to header 14.

[0017] Door 10 has around its periphery a hinge edge or stile 18, a latch edge or stile 20 spaced apart from the hinge stile. Edge is used in a broad sense herein and is meant to include both stiles and other types of door constructions that do not have stiles. The distance between hinge stile 18 and latch stile 20 inclusive defines the width of the door. A top rail 22 extends between hinge stile 18 and latch stile 20. A bottom rail 24 is spaced apart from top rail 22 and extends between hinge stile 18 and latch stile 20. The distance between top rail 22 and bottom rail 24 inclusive defines the height of the door. Preferably, hinge stile 18, latch stile 20, top rail 22, and bottom rail 24 are formed of steel. Hinge stile 18 is used to mount door 10 rotatably within frame 12. Latch stile 20 is used to mount a latch for holding a door in a closed position. Of course, those skilled in the art will recognize other materials may be used.

[0018] Outer skins 26A and 26B are mounted to hinge stile 18, latch stile 20, top rail 22, and bottom rail 24. One suitable material for outer skins is 18 gauge steel. If outer skins 26A and 26B, hinge stile 18, latch stile 20, top rail 22, and bottom rail 24 are formed of steel, MIG welding is a

suitable method for fastening outer skin to the stiles and rails. Of course, other methods using fasteners or adhesives may be used.

[0019] Outer skins 26A, 26B, and stiles 18, 20 and rails 22, 24 have a fire-resistant core 28 therebetween. Core 28 is formed of a plurality of spaced apart spacers 30 and a first sheet of fire-resistant insulating material 32 and a second sheet of fire-resistant insulating material 34 coupled to a respective first side and second side of the spacers 30. The thickness *T* of core is preferably the same thickness as hinge stile 18, latch stile 20, top rail 22, and bottom rail 24. That is, spacers 30 are preferably less than the thickness of hinge stile 18, latch stile 20, top rail 22, and bottom rail 24.

[0020] Spacers 30 may be formed of a number of materials including wood spacers, gypsum pads, concrete, corrugated cardboard, a honeycomb material, or as in the preferred embodiment, steel studs. Various cross-sectionally shaped steel studs may be used including rectangular, I-shaped, H-shaped, and irregular shapes. In one constructed embodiment the steel studs were 20 gauge, 1-1/16 inch by 1 inch.

[0021] The first sheet of fire-resistant insulating material 32 and the second sheet of fire-resistant insulating material 34 are preferably formed of a gypsum-based product. Of course, other fire-resistant mineral based products may be used. One suitable material for fire-resistant insulating material includes Dens-Deck® roof board manufactured by Georgia-Pacific Gypsum Corporation. In one constructed embodiment, for example, one-quarter inch Dens-Deck® material was used for each sheet. The Dens-Deck® material has a fibrous mat 35 (only a portion of which is shown in Figure 3)

exterior with a conventional gypsum board interior. The fibrous mat may, for example, comprise glass fibers which strengthen the material for handling during the door assembly. The gypsum interior may be formed from calcined gypsum and water in a known manner. Of course, other suitable fire-resistant insulating materials may also be used such as fiberglass.

[0022] The first sheet of fire-resistant insulating material 32 and the second sheet of fire-resistant insulating material 34 may be coupled to spacers 30 in various manners including the use of adhesives, fasteners or a combination thereof. Also, outer skins 26A and 26B may also be fastened to the first sheet of fire-resistant insulating material 32 and the second sheet of fire-resistant insulating material 34 through the use of adhesives. It should be noted that the fire-resistant insulating material may be finishable to provide a desirable aesthetically pleasing appearance. Therefore, outer skins 26A and 26B may be eliminated in some commercial embodiments.

[0023] A void 36 is preferably formed between spacers 30 and the first sheet of fire-resistant insulating material 32 and the second sheet of fire-resistant insulating material 34. Void 36 is essentially an air space. By providing a void rather than completely filling the door space with a relatively heavy fire-resistant insulating material the door weight is reduced.

[0024] Referring now to Figure 4, a fill material 38 may be used to fill void 36. Fill material 38 is preferably also fire-resistant insulating material and may comprise fiberglass insulation. Fiberglass insulation has the advantage of not

being as dense as a gypsum-based material and therefore does not substantially increase the weight of the door.

[0025] To assemble a door, the following process is preferably used. The steps described here may be formed in various orders and therefore is not meant to be limiting. In one constructed embodiment the steel studs were positioned at a maximum of twelve inches on center. Thus, for a large commercial door about four spacers 30 may be used as illustrated in Figure 1. The spacers 30 are preferably positioned vertically between and parallel with hinge stile 18 and latch stile 20. Those skilled in the art will recognize that various orientations of spacers 30 may be used depending on the type of spacer. The spacers 30 are also positioned between the top rail 22 and bottom rail 24. The first sheet of fire-resistant insulating material 32 and the second sheet of fire-resistant insulating material 34 are coupled to the spacers 30 and preferably extend to hinge stile 18, latch stile 20, top rail 22, and bottom rail 24. Fasteners or adhesives or a combination thereof may be used. If a thicker door is desired, the first sheet of fire-resistant insulating material 32 and the second sheet of fire-resistant insulating material 34 may extend over hinge stile 18, latch stile 20, top rail 22, and bottom rail 24.

[0026] The outer skins 26A and 26B are coupled to the first sheet of fire-resistant insulating material 32 and the second sheet of fire-resistant insulating material 34, respectively. Outer skins 26A and 26B may also be coupled to hinge stile 18, latch stile 20, top rail 22, and bottom rail 24. Once outer skins 26A and 26B are coupled thereto, the door may be installed into a frame prior to shipping or may be installed in the frame once on a jobsite. Hinges and other door

hardware (not shown) may be coupled to hinge stile 18 and a door latch to latch stile 20.

[0027] While particular embodiments of the invention have been shown and described, numerous variations and alternate embodiments will occur to those skilled in the art. Accordingly, it is intended that the invention be limited only in terms of the appended claims.